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(54) **Spinal rod coupler**

Verbindungselement für Wirbelsäulenstangen

Dispositif de liaison de tiges vertébrales

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Description

FIELD OF THE INVENTION

[0001] This invention relates to couplers for spinal rods and has specific relevance to a coupler having a body and a yoke for clamping connection to a spinal rod wherein the coupler body and yoke may be less than non-perpendicular with the spinal rod.

BACKGROUND OF THE INVENTION

[0002] Heretofore, couplers for connecting devices such as an open back hook or screw require the device to be substantially perpendicular to the supporting spinal rod. Such a requirement calls for the surgeon to position a spinal rod in an exact position for proper connection. EP-A-0 441 729 relates to a pedicle screw connector which allows some angular movement of the spinal rod although only in and out of the plane of the back of the patient, not in that plane. If the coupler is part of a rod to rod coupler, the spinal rods must be parallel to one another at their connection. This requirement for such an exacting rod position may lead to additional surgery time and may add further complications to an already complex and lengthy procedure to correct a spinal problem.

SUMMARY OF THE INVENTION

[0003] The coupler of this invention eliminates the problems discussed above by providing a two-piece coupler for a spinal rod including a yoke and a coupler body which may be positioned to clamp onto the spinal rod at an angle other than perpendicular relative to the rod. The yoke and body permit the spinal rod to be positioned plus or minus 15 degrees out of true perpendicular relative to the rod without sacrificing clamping strength. This advantage is particularly useful when the couplers are connected to a rod to rod interconnecting device to permit the rods to be less than parallel relative to one another. The accommodation of less than parallel rods or the non-perpendicular connection of the device to the spinal rods reduces the non-functional exact positioning of the spinal rods during surgery as is required by current couplers.

[0004] Accordingly, it is an object of the invention to provide for a novel coupler for a spinal rod.

[0005] Another object of the invention is to provide for a coupler for a spinal rod which accommodates a non-perpendicular connection between the rod and coupler.

[0006] Another object of the invention is to provide for a two-piece coupler for a spinal rod having a yoke and a body which may be positioned with the center axes out of alignment.

[0007] Still other objects of the invention will become apparent upon a reading of the following description taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is a perspective view of the coupler of the invention shown in use in association with a rod to rod coupler.

[0009] Fig. 2 is an exploded view of Fig. 1.

[0010] Fig. 3 is an exploded view of the coupler in association with a spinal rod and a spinal hook.

[0011] Fig. 4 is a plan view of Fig. 1 illustrating in broken lines the range of motion of spinal rods relative to the coupler.

[0012] Fig. 5 is a plan view with the spinal rod sectioned illustrating the yoke positioned on the rod prior to the body being clamped onto the rod.

[0013] Fig. 6 is the view of Fig. 5 sectioned with the coupler body pressed onto the yoke and the yoke in clamping engagement with the rod.

[0014] Fig. 7 is a plan view of the yoke.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] The preferred embodiments herein described are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Rather, they are chosen and described to best explain the invention so that others skilled in the art might utilize their teachings.

[0016] Referring now to Figs. 1, 2, and 4-6, the coupler of the invention is illustrated in conjunction with a telescopic rod to rod coupler 10. It should be understood that the invention described here is the coupler which includes a yoke and body. The body may be connected or formed to include a number of useful devices for spinal surgery such as a screw, a hook, a threaded screw shaft, or as illustrated in Figs. 1, 2, and 4-6, a rod to rod coupler.

[0017] Coupler 10 of the invention, as illustrated in Figs. 1, 2, and 4-6, includes a generally inverted U-shaped yoke 12 and a body 14. The U-shaped yoke 12 defines an upper wall 16 having a pair of integral legs 18 extending downwardly therefrom. The upper wall 16 includes an external bevelled edge 20. The distal end of each leg 18 includes a lip 22 extending outwardly and generally perpendicular from the lower edges thereof. As best illustrated in Fig. 7, the internal opening 24 of the yoke includes a generally arcuate portion 26 bordered on two sides by flat portions 28. As illustrated in Fig. 7, the aperture 30 formed between flat portions 28 is slightly narrower than the aperture formed by arcuate portion 26. Body 14 is generally C-shaped and includes an opening 32 for accommodating yoke 12. A centered and beveled recess 34 is formed in body 14 in communication with opening 32. Recess 34 forms a slight lip 36 on each end of the opening. Lips 36 constitute an abutment to prevent the yoke from shifting out of the opening in a direction parallel to the axis of the opening. A pair of slots 38 are formed in body 14 in communication with opening 32 near the open end of C-shaped

body 14 as illustrated in the figures. Bodies 14 of the rod to rod coupler of Figs. 1, 2, and 4-6 includes mutually cooperating rod portions 40 which telescopically engage one another to adjust the spacing between coupler bodies 14. A clamp 42 is provided on one rod portion 40 to fix the rod portions 40 relative to one another.

[0018] In use, to secure two space spinal rod 44 to one another using the coupler of the invention, the surgeon would first place a yoke 12 onto each rod by snapping the yoke over the rod or by partially assembling the yoke and coupler then snapping the assembly on to the rod. The reduced opening between the flat portions 28 causes an interference between the rod and yoke. It should be understood that the diameter of the spinal rod is equal to or slightly larger than the diameter of the arcuate section 26 and aperture 30 of the yoke. Therefore, to snap the yoke onto the spinal rod, legs 18 yield slightly under force of the spinal rod to seat the rod within the arcuate section of the yoke. Once the yoke is seated, the surgeon places the C-shaped body on top of the yoke and using a compressing tool forces the body over the yoke until lips 22 of the yoke seat within slots 38 of the body. (See Figs. 5 and 6). This orientation compresses legs 18 about the spinal rod to secure the rod, yoke and body together in fixed relationship. During assembly, after the yoke is placed onto the spinal rod, the axis 46 of the yoke opening is substantially parallel to the spinal rod with only a limited amount of axial movement. However, the yoke may be positioned in clamping engagement about the spinal rod such that the axis of body opening 32, as defined by line 48 in Fig. 2, and the axis of yoke opening 24, as defined by line 46 in Fig. 2, are at a relative angle or otherwise non-parallel. The resulting connection between the spinal rod and the body 14 of the coupler is non-perpendicular. Figure 4 illustrates the range of variance able to be achieved with the coupler of the invention. It should be understood that the yoke axis is parallel to the longitudinal axis of the rod; therefore the resultant angle between the rod and body 14 reflects the relative angle between the yoke and body. Contact between the spinal rod 44 and the edges of the C-shaped body about opening 32 define the angular extremes at which the spinal rod may be positioned. It should be explicitly understood that the range of angles or extreme positions possible using the invention as illustrated in Fig. 4 is only possible prior to the body 14 being compressed onto the yoke 14. Once the spinal rod, yoke, and body are compressed into the assembly of Fig. 6, the assembly is rigidly fixed to one another and does not permit movement.

[0019] The embodiment of Fig. 3 is provided as an illustrative example of the coupler mechanism of the invention used in conjunction with a spinal hook. In the illustration of Fig. 3, the spinal rod 44 and yoke 12 are identical in form and function to elements described above. The body 14' is operatively identical to body 14 previously described so far as the interworkings with the yoke and spinal rod are concerned. The difference be-

tween bodies 14 and 14' is that body 14' includes a hook 50 extending from the body as opposed to the rod portion 40 described earlier. In the embodiment of Fig. 3 the hook 50 would be for connection of a spinal rod to a vertebra of the patient.

[0020] The examples of possible use of the coupler mechanism of the invention should not be considered a limitation but are provided merely to more fully illustrate the usefulness of the invention. The coupler mechanism of the invention may find application in any number of situations not illustrated here such as, for example, in conjunction with a spinal screw.

[0021] Finally, it should be understood that the invention should not be limited to the details above but may be amended within the scope of the appended claims.

Claims

1. A coupler (10) for connection to a spinal rod (44), said coupler (10) comprising a yoke means (12) including an opening (24) for accommodating the spinal rod (44), the opening (24) of the yoke means (12) defining an axis, a body means (14) including an opening (32) for accommodating the yoke means (12) in compressing engagement with the spinal rod (44), the opening (32) of the body (14) defining an axis **characterised in that** the body means (14) allows the yoke means (12) to be accommodated such that the axis of the opening (24) of the yoke means (12) may be non-parallel to the axis of the opening (32) of the body means (14) and in that said yoke means (12) includes a generally U-shaped body having a pair of integral legs (18), each of the legs including a lip (22) extending outwardly therefrom generally transverse to the legs (18), the body means (14) being generally C-shaped and including a pair of slots (38) in communication with the opening (32) of said body means (14), each slot (38) accommodating a lip (22) of the yoke means (12) in an interference fit to retain the yoke means (12) within the opening (32) of the body means (14).
2. The coupler (10) of Claim 1 wherein the body means (14) further includes at least one lip (36) extending over the opening of the body means (14) to constitute a stop member to prevent the yoke means (12) from shifting along the axis of the opening (32) of the body means (14).
3. The coupler (10) of Claim 1 wherein said body means (14) further includes a secondary connection device for attaching the coupler body to a secondary fixation point.
4. The coupler (10) of Claim 3 wherein the secondary connection device includes hook body (50).

5. The coupler (10) of Claim 3 wherein the secondary connection device is a rod portion (40) forming a part of a telescopic rod.
6. The coupler of Claim 3 wherein the secondary connection device is a threaded screw shaft.
7. In combination, a spinal rod (44) and a coupling device (10) as claimed in claim 1, said spinal rod (44) having a longitudinal axis, said coupling device (10) being connected to said spinal rod (44) such that the coupling device (10) may be non-perpendicular to the longitudinal axis of the spinal rod (44).

Patentansprüche

1. Kuppler (10) zur Verbindung mit einer Spinalstange (44), wobei der Kuppler (10) aufweist: eine Jocheinrichtung (12) mit einer Öffnung (24) zum Unterbringen der Spinalstange (44), wobei die Öffnung (24) der Jocheinrichtung (12) eine Achse bildet, eine Körpereinrichtung (14) mit einer Öffnung (32) zum Unterbringen der Jocheinrichtung (12) im Preßeingriff mit der Spinalstange (44), wobei die Öffnung (32) des Körpers (14) eine Achse bildet, **dadurch gekennzeichnet, daß** es die Körpereinrichtung (14) der Jocheinrichtung (12) ermöglicht, so untergebracht zu sein, daß die Achse der Öffnung (24) der Jocheinrichtung (12) nicht parallel zur Achse der Öffnung (32) der Körpereinrichtung (14) sein kann, und dadurch, daß die Jocheinrichtung (12) einen allgemein U-förmigen Körper mit einem Paar einstückigen Beinen (18) aufweist, wobei jedes der Beine eine Lippe (22) aufweist, die sich davon allgemein quer zu den Beinen (18) nach außen erstreckt, wobei die Körpereinrichtung (14) allgemein C-förmig ist und ein Paar Schlitze (38) in Kommunikation mit der Öffnung (32) der Körpereinrichtung (14) aufweist, wobei jeder Schlitz (38) eine Lippe (22) der Jocheinrichtung (12) in einem Preßsitz aufnimmt, um die Jocheinrichtung (12) innerhalb der Öffnung (32) der Körpereinrichtung (14) festzuhalten.
2. Kuppler (10) nach Anspruch 1, wobei die Körpereinrichtung (14) ferner mindestens eine Lippe (36) aufweist, die sich über die Öffnung der Körpereinrichtung (14) erstreckt, um ein Anschlagteil zu bilden und die Jocheinrichtung (12) daran zu hindern, sich entlang der Achse der Öffnung (32) der Körpereinrichtung (14) zu verschieben.
3. Kuppler (10) nach Anspruch 1, wobei die Körpereinrichtung (14) ferner eine sekundäre Verbindungsvorrichtung zum Befestigen des Kupplerkörpers an einem sekundären Fixationspunkt aufweist.

4. Kuppler (10) nach Anspruch 3, wobei die sekundäre Verbindungsvorrichtung einen Hakenkörper (50) aufweist.

5. Kuppler (10) nach Anspruch 3, wobei die sekundäre Verbindungsvorrichtung ein Stangenabschnitt (40) ist, der einen Teil einer ausziehbaren Stange bildet.
6. Kuppler nach Anspruch 3, wobei die sekundäre Verbindungsvorrichtung ein Schraubgewindeschaf ist.
7. Kombination aus einer Spinalstange (44) und einer Kupplungsvorrichtung (10) nach Anspruch 1, wobei die Spinalstange (44) eine Längsachse hat, wobei die Kupplungsvorrichtung (10) mit der Spinalstange (44) so verbunden ist, daß die Kupplungsvorrichtung (10) nicht lotrecht zur Längsachse der Spinalstange (44) sein kann.

Revendications

1. Élément de liaison (10) pour la connexion à une tige vertébrale (44), ledit élément de liaison (10) comprenant un moyen formant étrier (12) présentant une ouverture (24) pour recevoir la tige vertébrale (44), l'ouverture (24) du moyen formant étrier (12) définissant un axe, un moyen de corps (14) incluant une ouverture (32) pour recevoir le moyen formant étrier (12) en prise de compression avec la tige vertébrale (44), l'ouverture (32) du corps (14) définissant un axe, **caractérisé en ce que** le moyen formant corps (14) permet que le moyen formant étrier (12) soit logé de façon que l'axe de l'ouverture (24) du moyen formant étrier (12) puisse être non parallèle à l'axe de l'ouverture (32) du moyen formant corps (14), et en ce que ledit moyen formant étrier (12) comprend un corps généralement en forme de U possédant une paire de branches intégrales (18), chacune des branches incluant une lèvre (22) s'étendant vers l'extérieur de celles-ci généralement transversalement aux branches (18), le moyen formant corps (14) étant généralement en forme de C et incluant une paire de fentes (38) en communication avec l'ouverture (32) dudit moyen formant corps (14), chaque fente (38) recevant une lèvre (22) du moyen formant étrier (12) selon un joint à ajustement serré afin de retenir le moyen formant étrier (12) dans l'ouverture (32) du moyen formant corps (14).
2. Élément de liaison (10) selon la revendication 1, où le moyen formant corps (14) comprend en outre au moins une lèvre (36) s'étendant sur l'ouverture du moyen formant corps (14) pour constituer un élément d'arrêt afin d'empêcher que le moyen formant étrier (12) se décale le long de l'axe de l'ouverture (32) du moyen formant corps (14).

3. Elément de liaison (10) selon la revendication 1, où ledit moyen formant corps (14) comprend en outre un deuxième dispositif de connexion pour fixer le corps de l'élément de liaison à un deuxième point de fixation. 5
4. Elément de liaison (10) selon la revendication 3, où le deuxième dispositif de connexion comprend un corps de crochet (50). 10
5. Elément de liaison (10) selon la revendication 3, où le deuxième dispositif de connexion est une portion de tige (40) faisant partie d'une tige télescopique.
6. Elément de liaison selon la revendication 3, où le 15 deuxième dispositif de connexion est une tige de vis fileté.
7. En combinaison, une tige vertébrale (44) et un élément de liaison (10) tel que revendiqué dans la revendication 1, ladite tige vertébrale (44) ayant un 20 axe longitudinal, ledit élément de liaison (10) étant relié à ladite tige vertébrale (44) de façon que l'élément de liaison (10) puisse être non perpendiculaire à l'axe longitudinal de la tige vertébrale (44). 25

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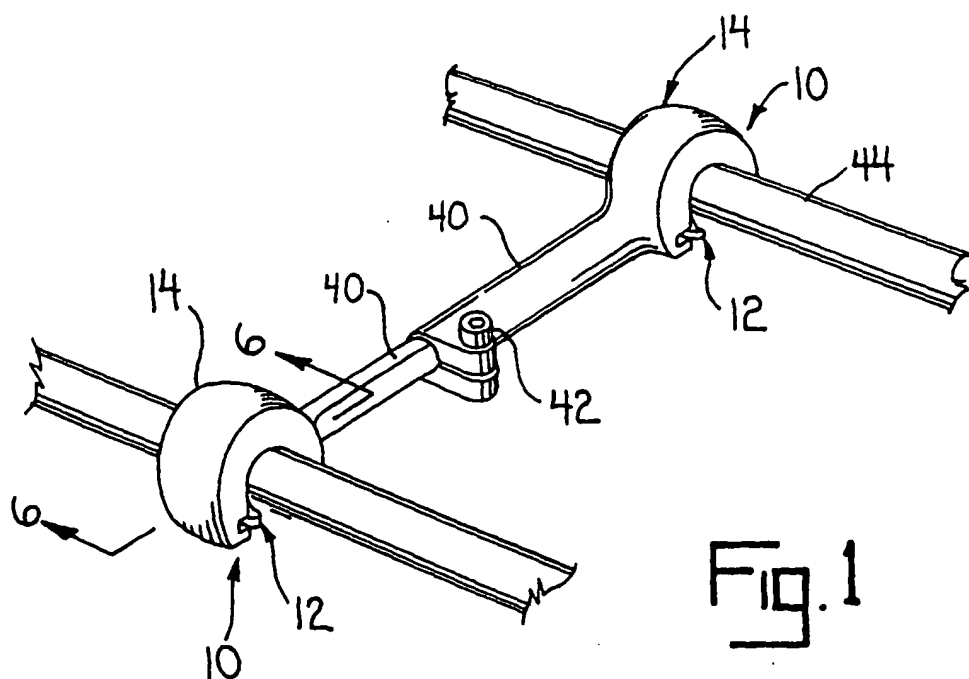


Fig. 1

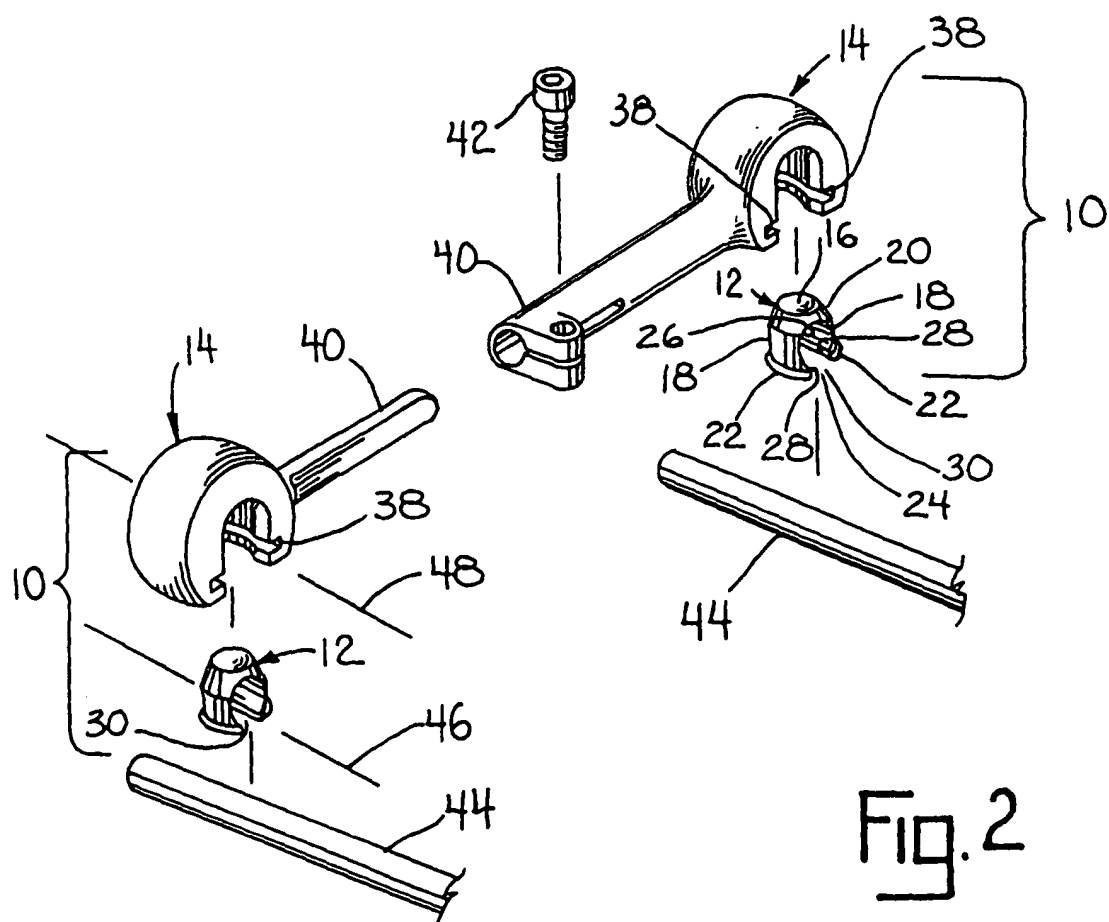


Fig. 2

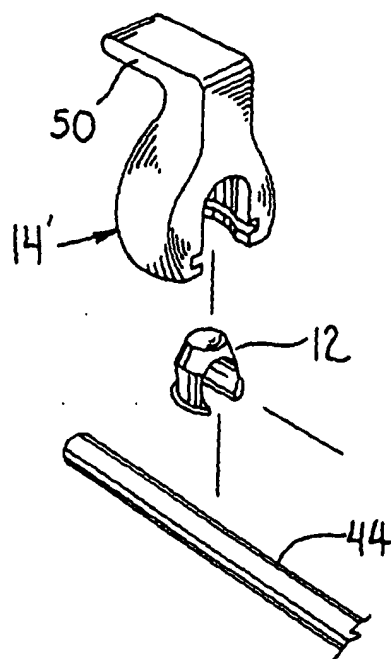


Fig. 3

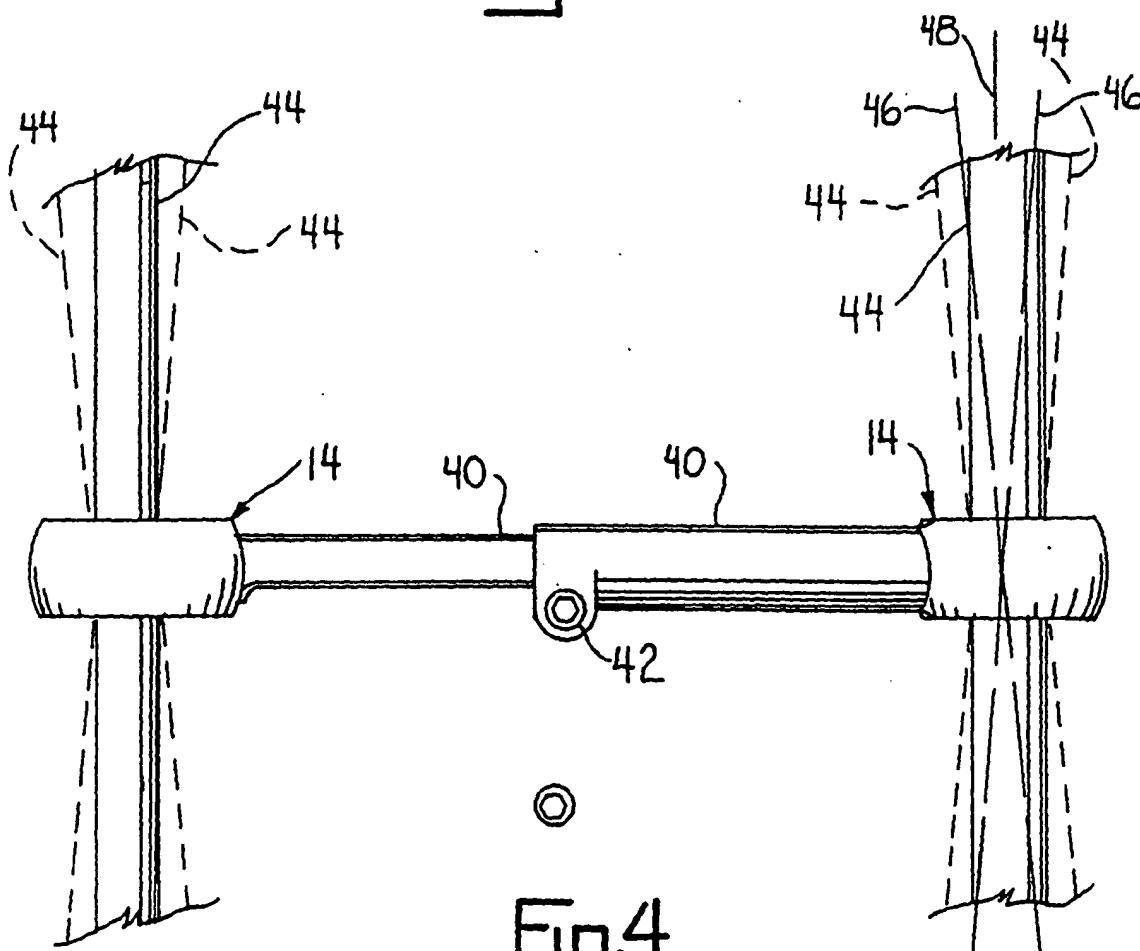


Fig. 4

